



Installation, Operation and Maintenance Manual

For

Emission Control Device (ECD)

WARNING

Do not attempt to operate ECD without first familiarizing yourself with these instructions. Improper operation of the equipment may result in injury to persons, loss of life, and damage to equipment.

Prepared By:
Cimarron Energy Inc.
1012 NW 24th Ave, Suite 100
Norman, OK 73069
405-928-7373
www.cimarron.com

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SAFETY SUMMARY

The following are general safety precautions for the operation and maintenance of the ECD system. Instructions contained in this Operating Manual are in addition to and do not replace the Operating Company's and Owner's existing operating procedures and policies with regard to standard safety precautions for flare operation and maintenance. This manual provides only basic guidance in the initial start-up and the normal operation of the ECD flare/combustor and is intended to be used by technically competent personnel familiar with and qualified in the operation and maintenance of the ECD flare equipment.

WARNING

ECD Flares are capable of producing extremely high heat radiation levels in close proximity to the flame. Personnel exposed to such radiation levels may suffer severe burns. Equipment located near the flame must be designed for high temperatures.



WARNING

ECD Flare systems may contain or produce toxic gases. Appropriate safety precautions must be taken whenever there is a potential for personnel exposure to flare gases. In particular, exposure may occur during close inspection of the flare tip or pilot and during removal or maintenance of equipment attached to the flare header.



WARNING

Direct Spark Igniters such as the ARC Igniter used in Cimarron ECDs generate high voltages capable to causing death. Use extreme caution when servicing the igniter module. Any circuit on which work is being performed should be de-energized and the switch should be locked open. Follow proper grounding procedures prior to energizing the igniter unit.



WARNING

Do not introduce condensed liquids into the ECD burner. Condensate/water liquids entering an ECD burner can cause uncontrolled flare-up or fire, erratic combustion and soot formation. These are extremely dangerous situations that can cause injury to personnel and destruction of equipment.

WARNING

During normal operation, ECD starts automatically whenever vent gas is present at the ECD burner. Follow ECD shutdown prior to any inspection or maintenance work on the unit.



WARNING

The internal space within the square base of ECD model ECD-3-48HV-90 is a confined space. Follow ECD shutdown and Company Confined Space Entry procedures prior to entry into the ECD-3-48HV-90 base unit.



INTRODUCTION

Cimarron ECDs (Emissions Control Device) are designed primarily for incineration of vent gases from tank battery atmospheric condensate, oil and produced water storage tanks. Emission losses from storage tanks in the oil and gas field processing industry include working losses, breathing losses, and flash losses (EIIP, 1999). Working losses refer to the combined loss from filling and emptying the tank (EIIP, 1999). Filling losses occur when the VOC contained in the saturated air are displaced from a fixed-roof vessel during loading (EIIP, 1999). Emptying losses occur when air drawn into the tank becomes saturated and expands, exceeding the capacity of the vapor space (EIIP, 1999). Breathing losses are the expulsion of vapor from a tank through vapor expansion caused by daily changes in temperature and pressure (EIIP, 1999). Flash losses occur when fluids exiting vessels at pressures above atmospheric enter storage tanks operating at atmospheric pressure which are vented to the atmosphere (EIIP, 1999). As the fluid pressure drops to atmospheric pressure, the gas which is entrained in the fluid is then released (TNRCC, 1996). Flash losses often exceed breathing and working losses (Boyer and Brodnax, 1996).

Cimarron ECDs come in various sizes based on the flow conditions of vent gases from the storage tank battery. The ECD is an Enclosed Ground Flare, as defined in API Publication 931 C15. The ECD is located at ground level and the burner head is located within the stack shell. The shell reduces noise, luminosity, and heat radiation and provides wind protection.

Cimarron ECD Meets CFR Title 40 Requirements

Cimarron ECD meets the requirements of CFR Title 40 §63.771(d)(1)(i) when operated as a control device per the requirements of CFR Title 40 §63.11(b) and the operating criteria of the specific ECD model listed in the Design Section. ECD is designed for greater than 98% Destruction Removal Efficiency (DRE) of total volatile organic compounds (TVOC) per CFR Title 40 §60, Appendix A Source Emission test methods.

Product Line Specifications

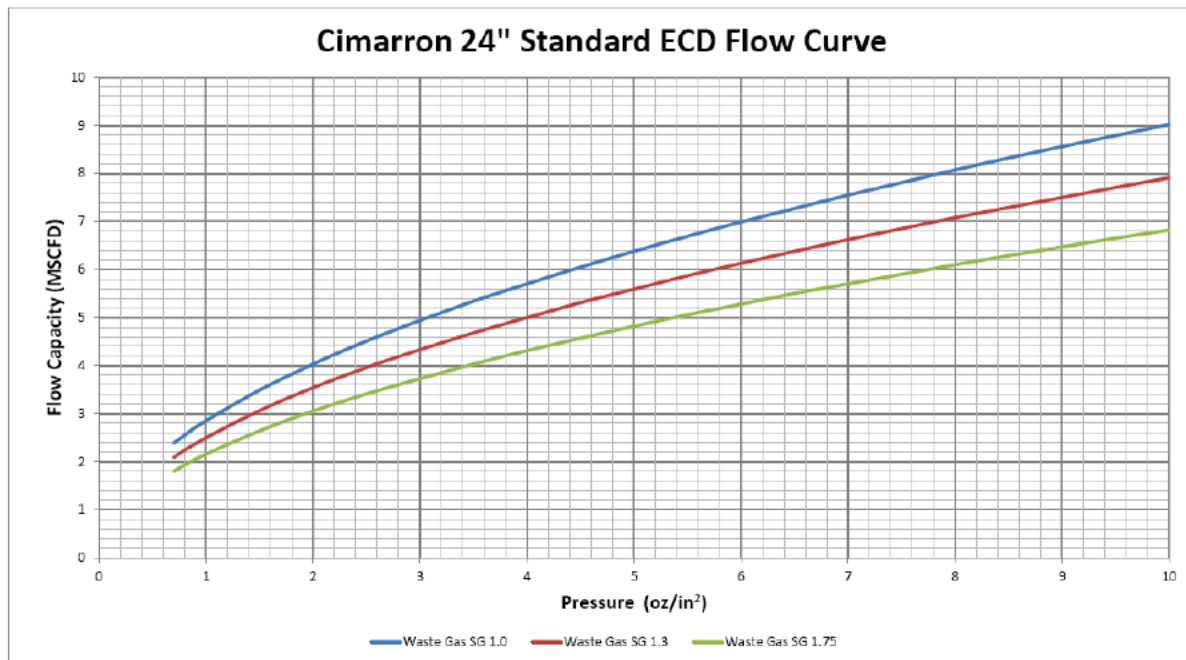
Model: ECD-2-24-64

Operational Design

Lower Operating Pressure: 1 oz/in²
Upper Operating Pressure: 10 oz/in²
TVOC Destruction Efficiency: >98% DRE when operated within pressure range



Calculated Flow Capacity Curve



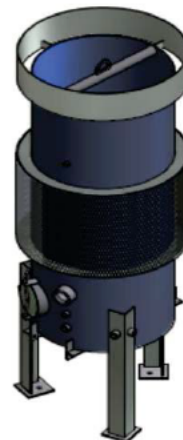
Mechanical Design

Overall Dimensions:	24" DIA x 100" Height
Weight:	Approx. 720 pounds (excludes Concrete Pad)
Burner:	64 Orifices
Stack:	Un-Insulated
Stack Internal Operating Temperature:	500 – 1200°F
Design Structure Wind Loading:	N/A – less than 20 ft tall
Ambient Temperature:	-20 to 120 °F
Electrical Area Classification:	Non-hazardous

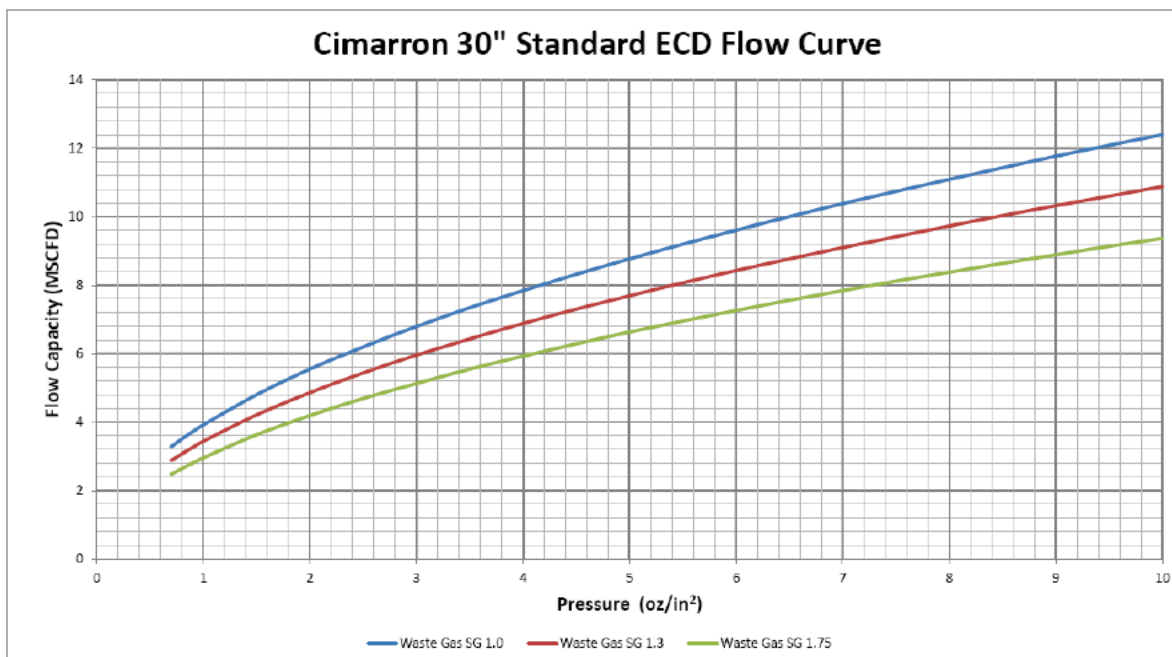
Model: ECD-2-30-88

Operational Design

Lower Operating Pressure: 1 oz/in²
Upper Operating Pressure: 10 oz/in²
TVOC Destruction Efficiency: >98% DRE when operating within pressure range



Calculated Flow Capacity Curve



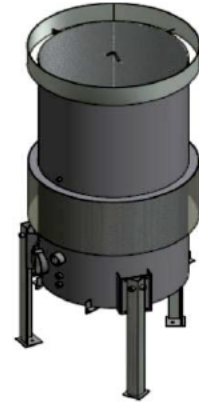
Mechanical Design

Overall Dimensions:	30" DIA x 102" Height
Weight:	Approx. 810 pounds (excludes Concrete Pad)
Burner:	88 Orifices
Stack:	Un-Insulated
Stack Internal Operating Temperature:	500 – 1200°F
Design Structure Wind Loading:	N/A – less than 20 ft tall
Ambient Temperature:	-20 to 120 °F
Electrical Area Classification:	Non-hazardous

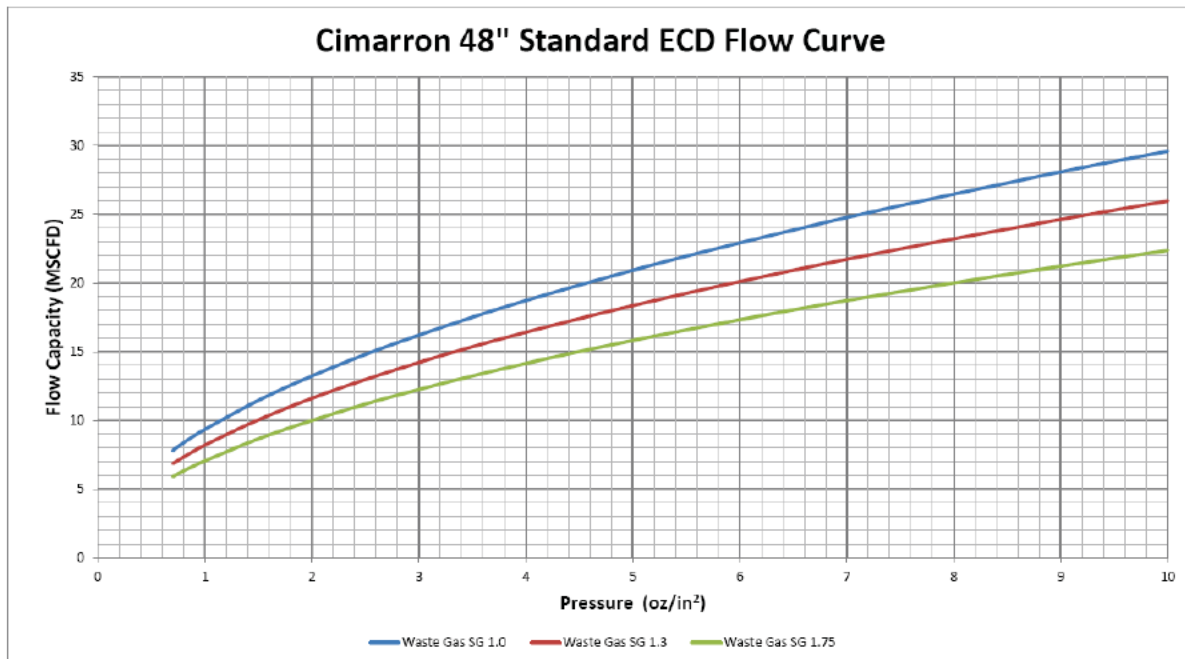
Model: ECD-2-48-210

Operational Design

Lower Operating Pressure: 1 oz/in²
Upper Operating Pressure: 10 oz/in²
TVOC Destruction Efficiency: >98% DRE when operating within pressure range



Calculated Flow Capacity Curve



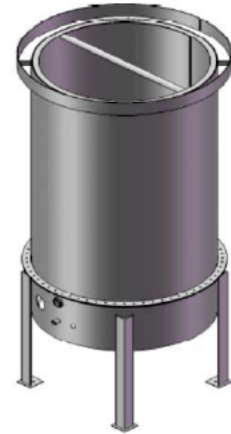
Mechanical Design

Overall Dimensions:	48" DIA x 139" Height
Weight:	Approx. 1,750 pounds (excludes Concrete Pad)
Burner:	210 Orifices
Stack:	Un-Insulated
Stack Internal Operating Temperature:	500 – 1200°F
Design Structure Wind Loading:	N/A – less than 20 ft tall
Ambient Temperature:	-20 to 120 °F
Electrical Area Classification:	Non-hazardous

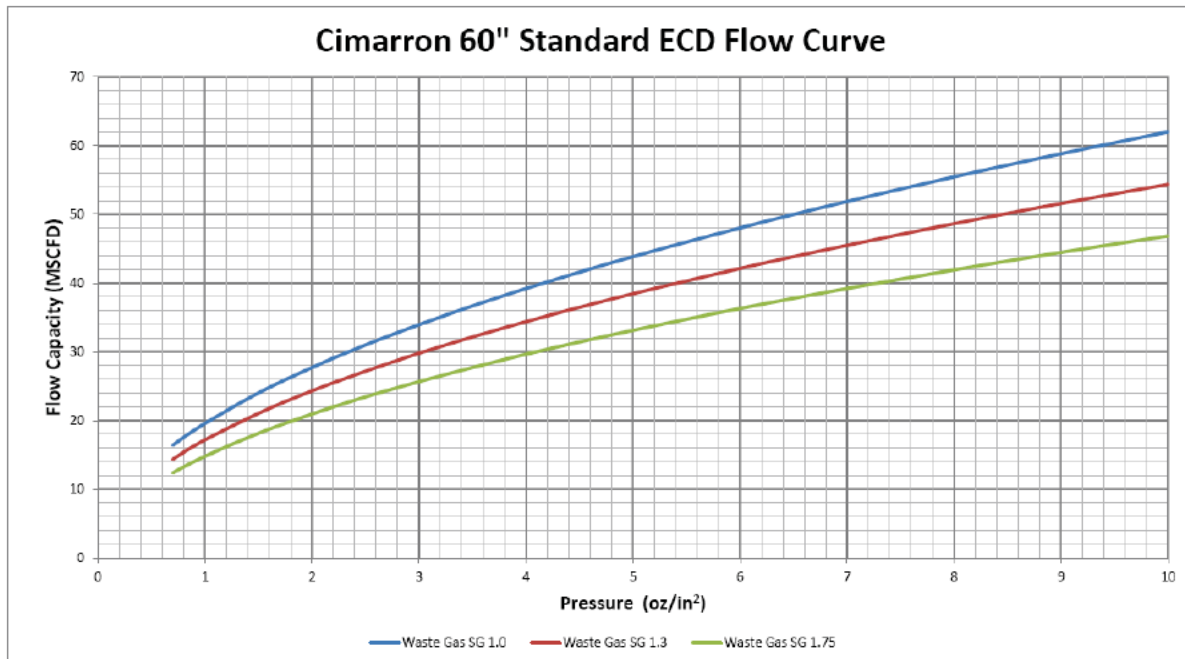
Model: ECD-3-60-440

Operational Design

Lower Operating Pressure: 1 oz/in²
Upper Operating Pressure: 10 oz/in²
TVOC Destruction Efficiency: >98% DRE when operating within pressure range



Calculated Flow Capacity Curve



Mechanical Design

Overall Dimensions:	60" DIA x 161" Height
Weight:	Approx. 2,150 pounds (excludes Concrete Pad)
Burner:	440 Orifices
Stack:	Insulated
Stack Internal Operating Temperature:	600 – 1500°F
Design Structure Wind Loading:	N/A – less than 20 ft tall
Ambient Temperature:	-20 to 120 °F
Electrical Area Classification:	Non-hazardous

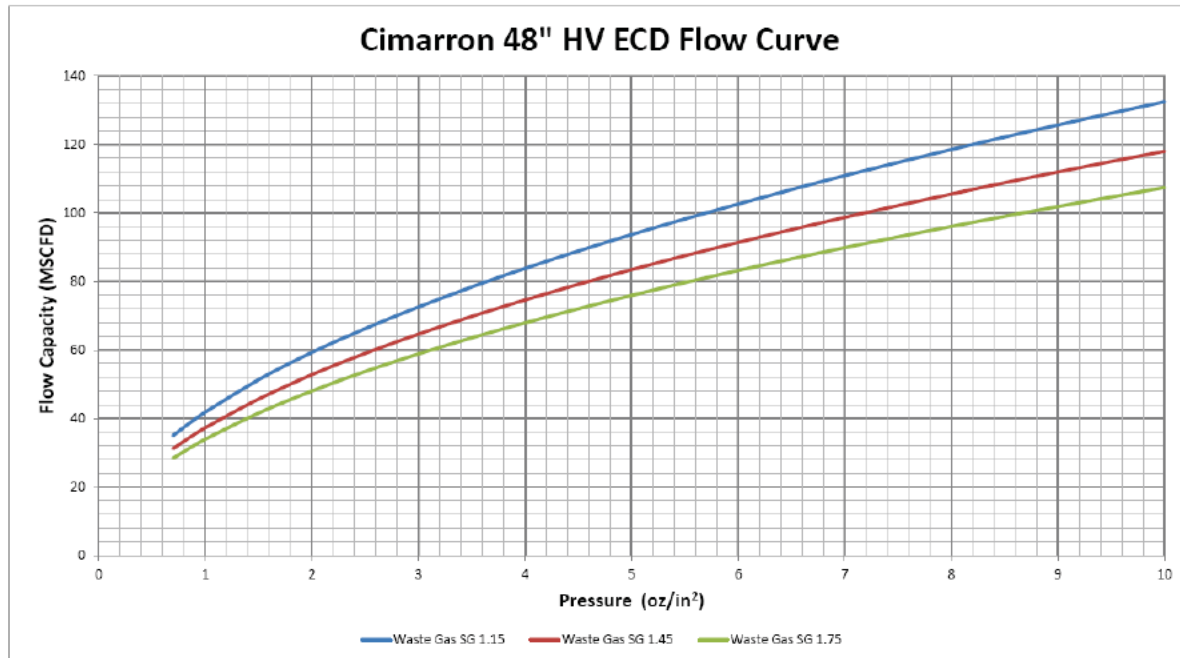
Model: ECD-3-48HV-90

Operational Design

Lower Operating Pressure: 1 oz/in²
Upper Operating Pressure: 10 oz/in²
TVOC Destruction Efficiency: >98% DRE when operating within pressure range



Calculated Flow Capacity Curve



Mechanical Design

Overall Dimensions:	56" Square Base x 303" Height
Weight:	Approx. 4,380 pounds (excludes Concrete Pad)
Burner:	90 Orifices (F-90)
Stack:	Insulated
Stack Internal Operating Temperature:	800 – 2000°F
Design Structure Wind Loading:	90 mph 3sec Wind Gust per ASCE 7-05
Ambient Temperature:	-20 to 120 °F
Electrical Area Classification:	Non-hazardous

ECD FIELD SET-UP AND INSTALLATION

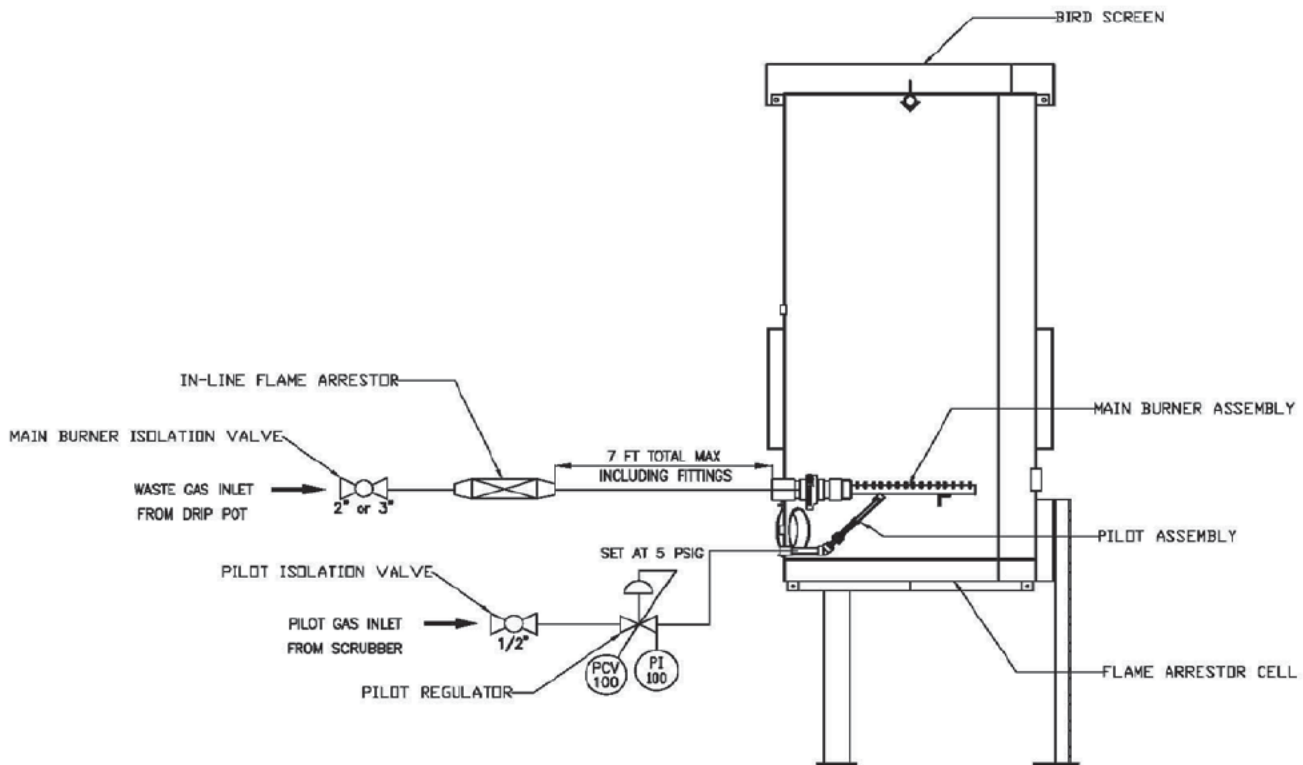
- 1) Identify location for ECD at a distance determined by company specifications and/or government requirements. See Figure 2 or Figure 3 for Cimarron recommendation.
- 2) Set the concrete pad at the determined location with the bottom flush with the level grade. The soil should be compacted and rated Class 4 or better (Soil Class referenced in Table 1804.2 of IBC 2006 Edition). ECD concrete pad **must not** be set on Class 5 soils (clay, sandy clay, silty clay, silt and sandy silt) as defined and referenced in Table 1804.2 of IBC 2006 Edition.
- 3) Erect ECD and anchor to concrete pad. Tighten all bolting follow bolting manufacturer torque specifications. Contact Cimarron for assistance with these bolting specifications.
- 4) Locate Fuel Gas Scrubber for the pilot gas supply and pipe up according to Figure 1.
- 5) Locate Drip Pot (Manual Dump) and pipe up according to Figure 2 or Figure 3. The Drip Pot may also be equipped with an automatic level controlled dump and associated liquids booster or pumping system. In this case, the Drip Pot may be located adjacent to the stock tanks as in Figure 3, thus requiring short liquid dump lines back to the stock tanks.

Note 1: Make sure pipe from Stock Tank is sloped to the Drip Pot at an angle of approximately 1 inch per 10 feet. It is also recommended that the vent gas pipe is insulated to minimize liquid condensation as a result of low ambient temperatures.

Note 2: It is recommended that the condensed liquid line back to the tanks be protected from freezing (buried, insulated, etc.).

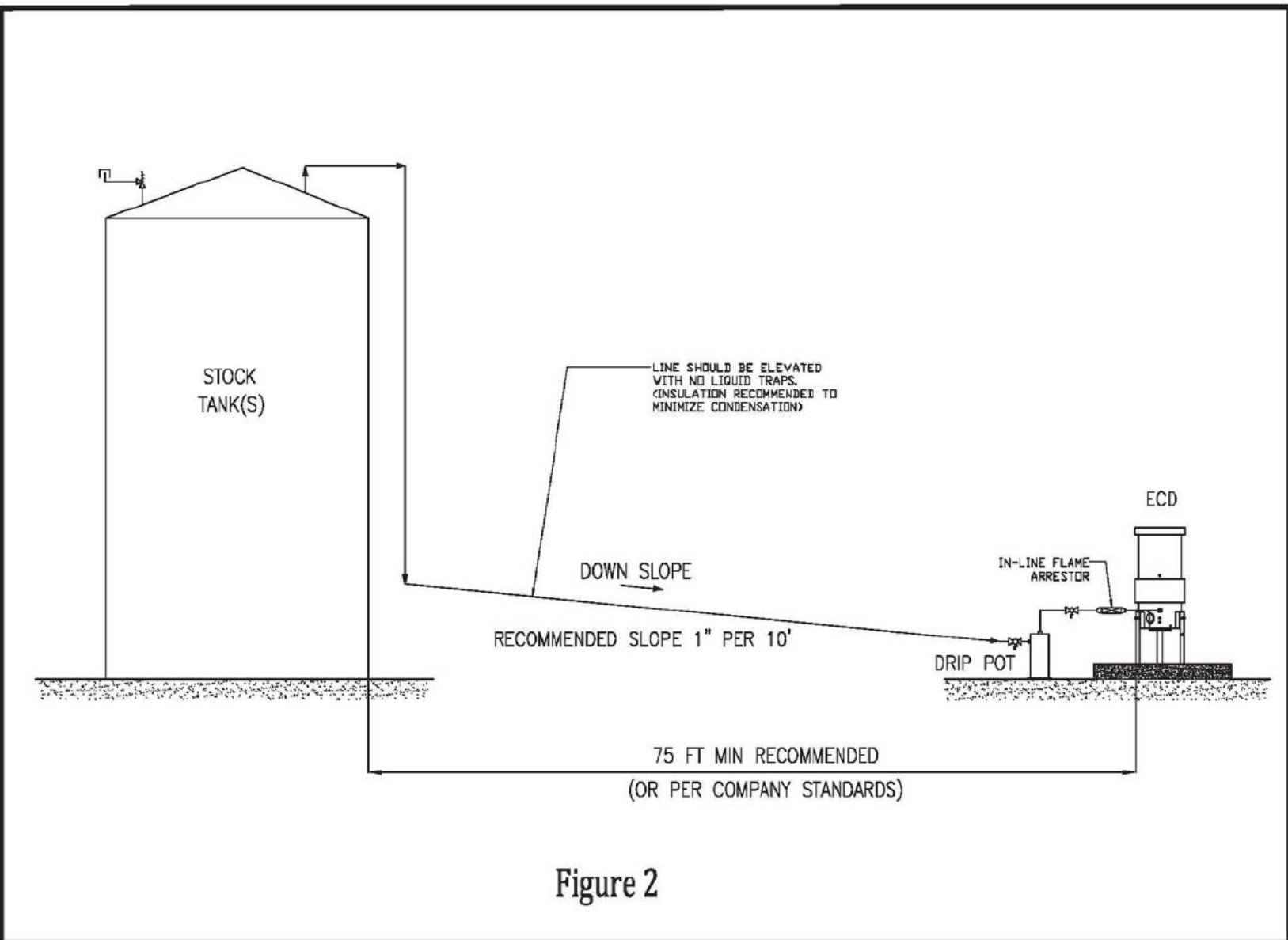
- 6) Install the in-line gas flame arrestor as indicated in Figure 1. It is imperative this flame arrestor does not exceed a maximum piping length (including fittings) of seven(7) feet from the main burner. It is recommended that hammer union connections are installed upstream and downstream of this gas flame arrestor for easy maintenance access.
- 7) Install Pilot light assembly as shown in Figure 1.
- 8) Mount Solar Panel with leg support bracket or alternate pipe mounting system.
Note: Locate and face the panel in the direction that receives the most sunlight during the day.
- 9) Locate the ARC Igniter and place on the flat surface on the side of the ECD (see page 14).
- 10) Wire the ARC Igniter to the solar panel and pilot according to ARC Igniter Installation (see page 14).
- 11) After all piping and wiring is completed, supply gas to the fuel gas scrubber (125psig max).
- 12) Open pilot gas isolation valve and set pilot pressure regulator at 5 to 7 psig.
- 13) Start up the ARC Igniter as directed in the ECD Start-up procedures (pg. 16).
- 14) Once pilot is lit and operating satisfactorily, vent gas from tanks may be introduced to the system.

Note: It might take up to 15 minutes for the vent gas to purge the air out of the waste gas line to the ECD and provide sufficient gas to fully combust.



WARNING: To Reduce the risk of back-draft fire or explosion, it is imperative to install the *In-Line Flame Arrestor* before the system is put into service.

Figure 1



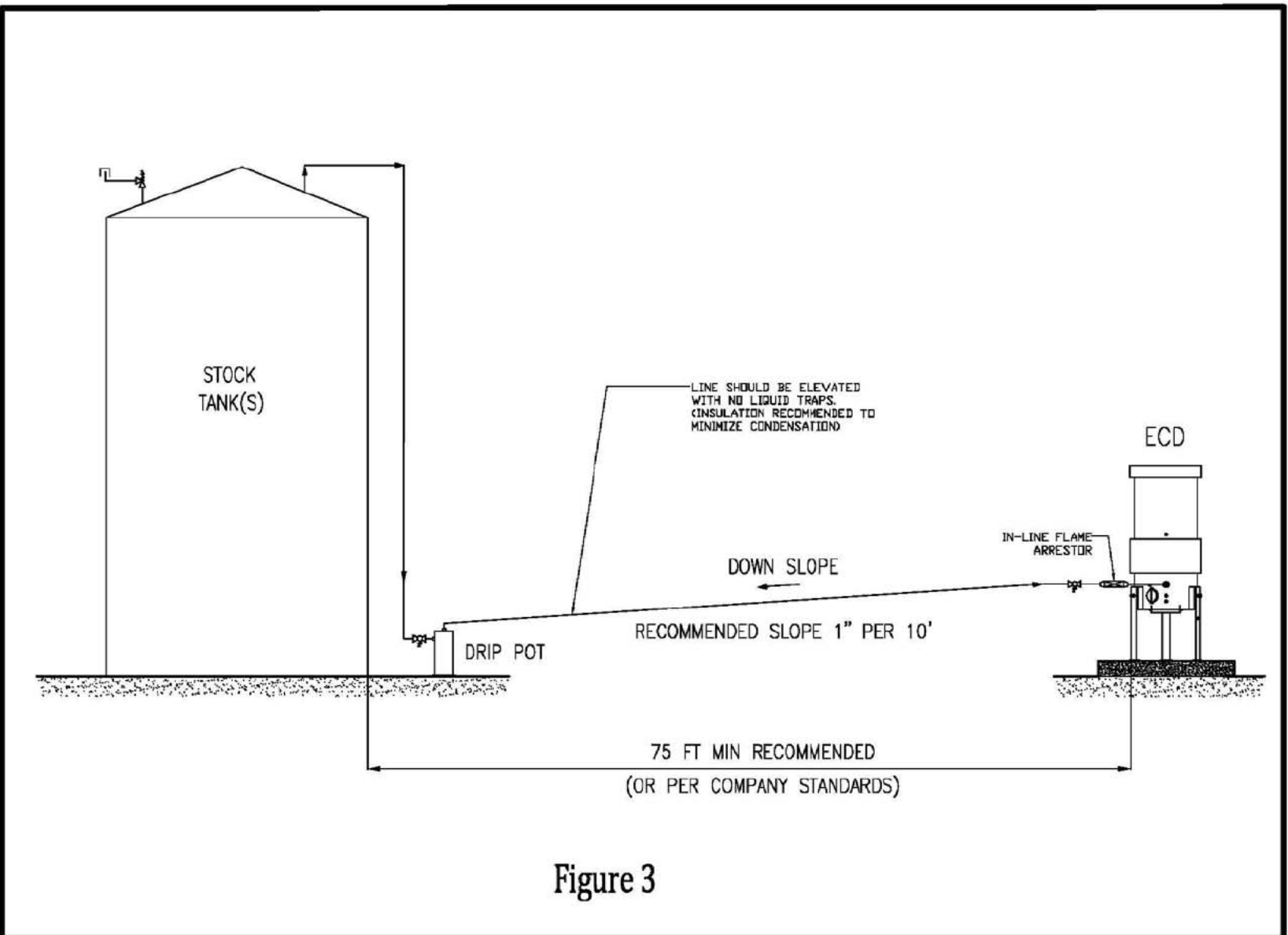


Figure 3

ARC PILOT INSTALLATION AND TROUBLESHOOTING

Cimarron ARC Pilot Igniter Installation

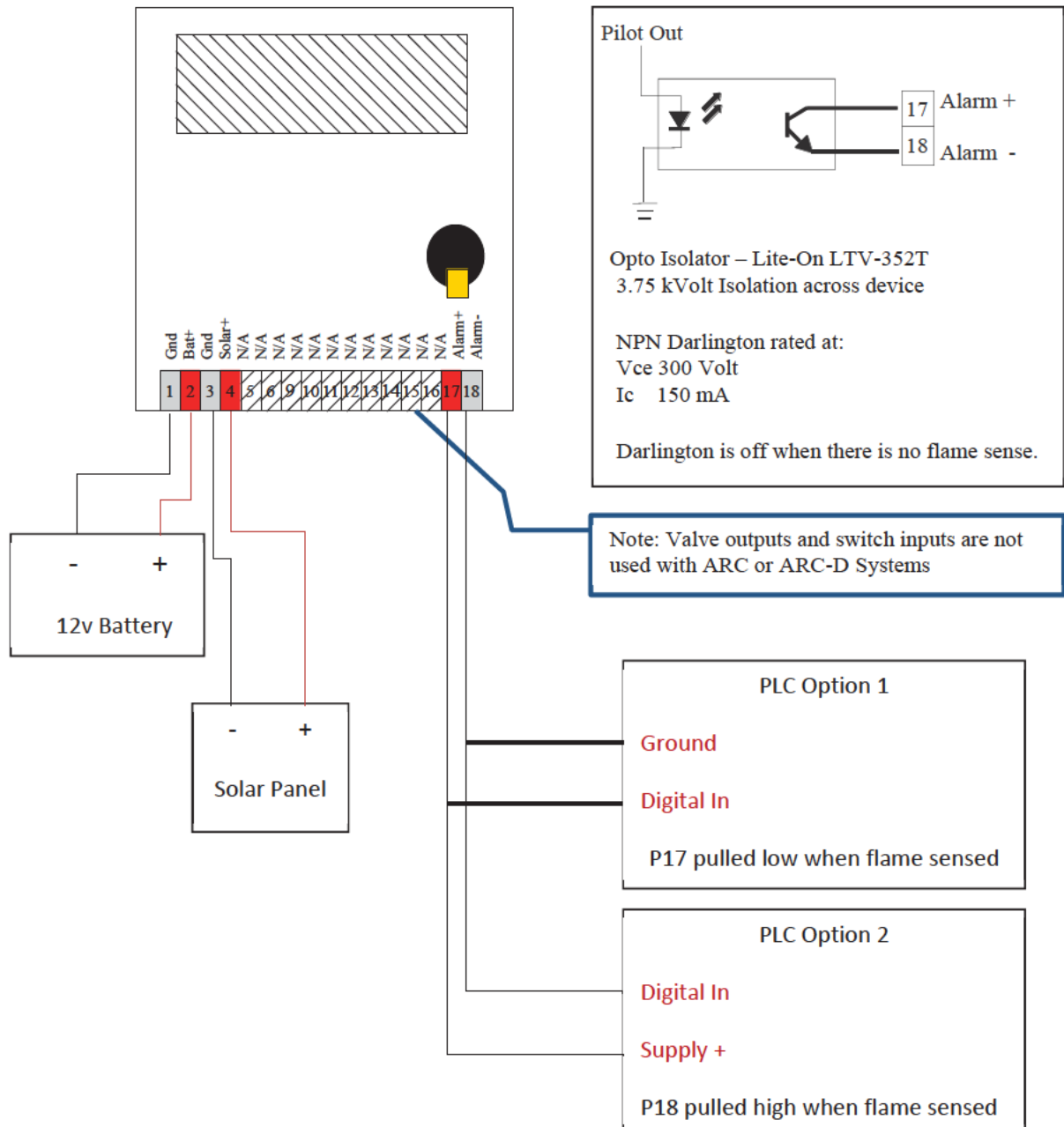
- 1) Mount igniter unit on supplied mounting bracket or on a vertical surface away from heat. Also refer to ARC Troubleshooting Guide Document 1200-100 for more information.
- 2) Cut and install conduit and connectors.
- 3) Refer to Schematic A and follow the instructions below:
 - a) Cut the igniter wire and to the length needed and run it inside the conduit and connect the igniter wire with female spade connector to the coil inside the ARC.
 - b) If using a solar panel, run the wire through the liquid tight fitting on the bottom of the unit and attach to the positive and negative solar terminals of the terminal block marked "Solar".
 - c) Install electrode Igniter to cleanly grounded $\frac{1}{2}$ " pipe (Igniter Tip should be a $\frac{1}{4}$ " inside pilot rosebud and $\frac{3}{32}$ " to $\frac{5}{32}$ " away from sidewall of rosebud).
 - d) Connect electrode to the end of the igniter wire.
- 4) Check wiring to ensure proper connection and connect the battery to test the unit.

Note: It is the Installer's/User's responsibility to adhere to all Local, State and Federal codes for wiring and gas connections.

ARC Troubleshooting

Refer to ARC Troubleshooting Guide Document 1200-100.

Schematic A - Wiring Diagram for ARC and ARC-D Systems



ECD OPERATION

Operation Caution: For safety, ensure flame arrestor is secure and in proper working order prior to lighting flame. It is recommended to follow API RP-12N (latest edition) for testing the flame arrestor and accessories.

ECD Start-up

- 1) Make sure the ARC Igniter battery has a full charge and all the terminal connections are tight with no loose wiring. Keep the manual valves that control the pilot and main burner gas lines closed until ready to ignite.
- 2) Open ARC enclosure box and turn the power switch to the "On" position. The LCD will display the "Firmware Series" and then state "Igniting Pilot".
- 3) With the ARC displaying "Igniting Pilot", slowly open pilot isolation valve to light pilot.
- 4) Once pilot flame is established, slowly open the Main Burner isolation manual valve.
- 5) Close thief hatches on tanks and tank blow down valves to maintain a closed vent gas system to the ECD.

Note: It is recommended that the entire stock tank vent gas system be a closed system without any system gas leaks. All vent gases generated in the stock tanks should be directed to the ECD for emission destruction. If stock tank unloading is performed without a vapor equalizing loop back to the stock tank, a vacuum breaker should be installed in the vent gas line to prevent stock tank implosion. A vacuum breaker is nothing more than a check valve permitting draw of ambient air into the vent system during the truck loading operation. In the absence of a vacuum breaker, the thief hatch on the unloaded stock tank will need to be opened for the duration of the truck loading operation.

ECD Shutdown

- 1) Open thief hatches and blow down valves on stock tanks.
- 2) Close Main Burner Isolation Valve at ECD and Lock-out/Tag-out (LO/TO).
- 3) Close Pilot Isolation Manual Valve at ECD and LO/TO.
- 4) Turn ARC Ignition System "Off".
- 5) Open ECD access cover (all models except ECD-3-48HV-90) or the access door (Model ECD-3-48HV-90) and ventilate for minimum of 15 minutes or per Company Policy.

LIQUID DRIP POT

There are two different configurations for dumping the liquid drip pot as it is separated from the vent gas before it is burned in the ECD.

- 1) The first configuration uses a Drip Pot where the liquid has to be manually dumped.
- 2) The second configuration uses an automated liquid dump Drip Pot. In this system the liquid is automatically dumped back into the tanks or separate reservoir/sump.

Operation:

- a) When vent gas from the tanks enter the Drip Pot, the gaseous components continue out through the connection near the top of the drip pot to the ECD and the entrained liquids drop to the bottom.
- b) As liquids accumulate in the drip pot, the level will rise and trip the level control.
- c) The level control will open a low control valve and pressure up the drip pot and “boost” the liquid enough to push it back into the stock tank(s). Alternatively, a gas powered pump can used to pump the liquid back to the stock tank(s).

DANGER

It is imperative that liquids are not introduced into the ECD burner. Condensate/water liquids entering an ECD burner can cause uncontrolled flare-ups, erratic combustion and soot formation. These are extremely dangerous situations that can cause injury to personnel and destruction of equipment.

MAINTENANCE

This section suggests a periodic inspection of key components of the ECD at various intervals. The frequency of the inspection is a recommendation and can be modified based on Company policy. If equipment troubleshooting indicates a problem with a specific component, follow the maintenance instructions as described.

Liquid Drip Pot

Daily or as needed, manually drain fuel gas scrubber and the Drip Pot into approved container and dispose/collect per company guidelines.

Pilot Fuel Gas Scrubber

Daily or as needed, manually drain fuel gas scrubber and the Drip Pot into approved container and dispose/collect per company guidelines.

Operating Pressures

Routinely (daily) check Pressures.

- Pilot Regulator should be set between 5 and 7 psig.
- ECD should be operating at low pressures of 1 oz/in² to 10 oz/in².

Air Flame Arrestor Cells

All ECDs except ECD-3-48HV-90

It is recommended to check the Air Flame Arrestor Cell at bottom of ECD on a semi-annual basis.

- 1) Shutdown ECD (as listed on page 16) prior to inspection.
- 2) Open the access cover on the side of the ECD stack and inspect the air cell for dirt or other foreign material. This contamination will plug the fluted openings within the air cell and decrease air flow to the burner.

Note: Severely dirty Air Flame Cell can cause ECD to start smoking.

- 3) In cases of light blockage, it may be possible to dislodge foreign material(s) by introducing compressed air upward from the bottom of the air cell. Use a cleaning nozzle with less than 90 psig of compressed air. Care must be taken not to damage the flutes on the air cell.
- 4) If foreign material blockage is more severe, remove the air cell for cleaning:
 - a) Remove the bolting on the hold-up angle brackets supporting the air cell. Additional field assistance may be required to bear the weight of the air cell.

- b) Once removed, use high pressure water spray to dislodge foreign material blockage of the air cell.
- c) Air dry the flame cell and re-install the air flame cell.

ECD-3-48HV-90

It is recommended to check the Air Flame Arrestor Cells in the base unit of the ECD on a semi-annual basis.

- 1) Shutdown ECD (as listed on page 16) prior to inspection.
- 2) Open the access door on the base unit of the ECD and perform a "Confined Space Entry Permit" procedure per company policy.
- 3) Carefully enter the base unit and inspect all four (4) air cells for dirt or other foreign material. This contamination will plug the fluted openings within the air cell and decrease air flow to the burner.

Note: Severely dirty Air Flame Cell can cause ECD to start smoking.

- 4) In cases of light blockage, it may be possible to dislodge foreign material(s) by introducing compressed air outward from the inner surface of the air cell. Use a cleaning nozzle with less than 90 psig of compressed air. Care must be taken not to damage the flutes on the air cell.
- 5) If foreign material blockage is more severe, remove the air cell for cleaning:
 - a) Remove the bolting on the hold-up angle brackets supporting the air cell. Additional field assistance may be required to bear the weight of the air cell.
 - b) Once removed, use high pressure water spray to dislodge foreign material blockage of the air cell.
 - c) Air dry the flame cell and re-install the air flame cell.

ARC Igniter

Periodically (monthly recommended) test the ARC Igniter per instructions in the ARC Troubleshooting document 1200-100.

In-line Gas Flame Arrestor

It is recommended to check the In-line Gas flame arrestor in the piping to the ECD on an annual basis.

- 1) Shutdown ECD as described on page 16 prior to inspection.
- 2) It is not possible to inspect the in-line gas flame arrestor in place. Remove the in-line arrestor from the piping and inspect the flutes in the arrestor for debris blockage. The use of hammer unions upstream and downstream of this arrestor would make this task easier.
- 3) Use compressed air at less than 90 psig to dislodge debris. If cleaning is not possible in the field, replace in-line flame arrestor with a spare unit (which is available from Cimarron).
- 4) Re-install in-line arrestor in the piping. Assure that all piping threads are tight and gas does not leak from the pipe threads.

Main Burner

Burner Removal (All ECDs except ECD-3-48HV-90)

- 1) Complete shutdown of ECD is required prior to this process as described on page 16.
- 2) Remove the Air Cell on bottom of ECD per the instructions on page 18 to access the burner assembly.
- 3) Disconnect Ignition Cable and Igniter Tip to the pilot assembly.
- 4) Disconnect pilot fuel gas piping at the Hex union and remove Pilot assembly bracket. Carefully remove pilot assembly out of the way.
- 5) Disconnect the waste gas piping to the main burner at the hammer union. Remove the bolting on the burner bracket and carefully remove burner assembly. Additional field assistance may be necessary to bear the weight of the burner.
- 6) Inspect the burner per the guidelines below.
- 7) Re-install all components removed in reverse order and verify that all piping connections are tight and secure.

Burner Removal (ECD-3-48HV-90)

- 1) Complete shutdown of ECD is required prior to this process as described on page 16.
- 2) Open the access door on the base unit of the ECD and perform a "Confined Space Entry Permit" procedure per company policy.
- 3) Carefully enter the base unit.
- 4) Disconnect Ignition Cable and Igniter Tip to the pilot assembly.
- 5) Disconnect pilot fuel gas piping at the Hex union and remove Pilot assembly bracket. Carefully remove pilot assembly out of the way.
- 6) Disconnect the waste gas piping to the main burner at the hammer union. Remove the bolting on the burner bracket and carefully remove burner assembly. Additional field assistance may be necessary to bear the weight of the burner.
- 7) Inspect the burner per the guidelines below.
- 8) Re-install all components removed in reverse order and verify that all piping connections are tight and secure.

Burner Inspection and Cleaning

Burner inspection and cleaning is recommended on a semi-annual schedule.

All ECDs except ECD-3-48HV-90

With burner assembly removed from ECD, verify that all jets are clean and in good working order (replace any jets that are plugged, destroyed or missing).

ECD-3-48HV-90

With burner assembly removed from ECD, verify that all orifices are clean and in good working order (consult with Cimarron if there are issues).

REFERENCES

Boyer, Brian E. and Kenneth Brodnax, 1996. *Oil and Gas Production Emission Factors and Estimation Methods*. Complete Oil Field Management and Maintenance, Inc., Lafayette, Louisiana, and Mobil Exploration and Production Company, Houston, Texas. Presented at the Emission Inventory: Key to Planning Permits, Compliance and Reporting Conference, Air and Waste Management Association, September 4-6, 1996, New Orleans, Louisiana.

EIIP. 1999. *Preferred and Alternative Methods for Estimating Air Emissions from Oil and Gas Field Production and Processing Operations, Volume II, Chapter 10*. Prepared for the Point Sources Committee, Emissions Inventory Improvement Program under EPA Contract. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.

TNRCC. 1996. *Technical Guidance Package for Annual Air Emissions Inventory Questionnaires, Oil and Gas Industry, Draft*. Texas Natural Resource Conservation Commission. Austin, Texas.